

ADDENDUM 1

RI/FS WORK PLAN FOUR COUNTY LANDFILL

**Four County Landfill Site
Fulton County, Indiana**

**Prepared for:
The Four County Landfill Group**

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1.0 INTRODUCTION

The overall objective of the RI is to gather sufficient information to complete an evaluation of the nature and extent of contamination for the purposes of assessing Site risk and ultimately selecting an appropriate Site remedy. In light of the data generated to date during the RI, supplemental investigative activities are necessary in order to adequately evaluate the nature and extent of contamination at the Site. More specifically, additional data are required to adequately assess the extent of groundwater contamination in the vicinity of the Site.

The Four County Landfill Technical Committee, in a memorandum to IDEM dated February 10, 1995, proposed to divide the Four County Landfill Site into two operable units. The first operable unit (OU-1) is the landfill cap and the second operable unit (OU-2) is groundwater. The primary benefit of dividing the Site into operable units is that the approach allows for the flexibility to close and stabilize the landfill on a separate timetable from the groundwater investigation which may require several phases to complete. In effect, a protracted groundwater investigation, if required, will not hinder the schedule for closure of the landfill.

This Addendum to the approved RI/FS Work Plan outlines the additional scope of work necessary to determine the nature and extent of groundwater contamination. This Addendum sets forth the rationale for these tasks and details data collection and analytical protocols which have not been previously established by the Sampling and Analytical Plan (SAP) provided as Appendix H of the approved RI/FS Work Plan. Additionally, this Addendum details the steps necessary for the abandonment of the remaining on-Site monitoring wells which were improperly constructed for a landfill setting and may act to facilitate migration of Site-related compounds between distinct geologic units.

Data gathering objectives for the supplemental RI activities set out herein include:

- i) determination of the areal extent of off-Site migration, if any, of perched groundwater containing leachate within Unit A beyond the western property boundary;
- ii) installation of off-Site groundwater monitoring wells to further delineate the extent of groundwater contamination in the vicinity of the Site;
- iii) collection of groundwater analytical data from piezometers screened in Unit A, from which a complete set of groundwater analytical data specified by the RI/FS Work Plan could not be collected during the initial sampling round (to the extent sufficient media is available for sampling); and
- iv) abandonment of all remaining on-Site monitoring wells which were improperly constructed for a landfill setting and may provide preferential contaminant migration pathways between distinct geologic units.

A summary of the additional investigative tasks proposed and the rationale for performance of these tasks is provided in the following sections.

2.0 OFF-SITE UNIT A INVESTIGATION

As discussed in the RI/FS Work Plan, unconsolidated geologic units which overlie bedrock beneath the Site are approximately 220 feet in thickness. During previous investigations these unconsolidated geologic units have been divided into four major lithostratigraphic units. The uppermost lithostratigraphic unit, Unit A, consists of a thickness of glacial till comprised primarily of loam and silt loam. Site investigations conducted prior to the RI identified that groundwater in the Unit A till sequence occurs in relatively thin, discontinuous perched zones within stratified intertill sand and gravel seams. Moreover, monitoring wells screened in Unit A did not yield significant quantities of water and did not have consistent water level readings. These observations were confirmed by the data generated during the previous sampling round. As reported in the Groundwater Technical Memorandum, ten piezometers screened in Unit A were observed to be dry and a full sample volume could not be retrieved from five other Unit A piezometers due to insufficient groundwater production from these wells.

The greatest number and magnitude of VOC detections were observed in perched groundwater samples collected from Unit A piezometers located near the western property boundary. More specifically, the Unit A piezometers in which the most elevated VOC concentrations were observed included P-2A, P-10, P-12A, P-13A, and P-14A. This same observation is also true for SVOCs; however, the number and magnitude of SVOC detections were much less than the number and magnitude of VOCs observed in these same piezometers.

Groundwater flows from areas of higher hydraulic head to areas of lower hydraulic head. In the perched groundwater units at the Site, the hydraulic head within the perched units is greater than the hydraulic head in the underlying water table. Therefore, groundwater will flow from the perched units vertically downwards towards the underlying water table. However, if relief is present on the confining unit underlying the perched unit, groundwater may also flow laterally under the influence of gravity from topographically higher areas to topographically lower areas.

The off-Site Unit A investigation will involve the performance of an intrusive investigation on the property located west of the Site. The objective of the investigation is to determine the areal extent, if any, of groundwater containing elevated levels of VOCs which may have been transported laterally within Unit A to the adjacent lands west of the Site. To accomplish this objective, the investigation will include advancement of soil borings, collection of soil samples for field screening and laboratory analysis and collection of perched water samples for laboratory analysis. VOCs were selected as indicator compounds as part of this investigation since VOCs are generally more soluble than SVOCs and substantially more mobile in the subsurface environment.

A series of soil borings will be advanced to a maximum depth of 25 feet below ground surface using a rotary drill rig and hollow-stem augers. Split spoon samples will be collected at regular intervals in order to identify the presence and thickness of any sand lenses encountered. An experienced geologist will describe each sample collected in accordance with the Unified Soil Classification System (USCS). Field screening of the collected soil samples will be performed using a photoionization detector (PID) and head space screening techniques to assist in identifying any discrete zones where elevated concentrations of VOCs may be present. The lead auger will be screened to allow entry of any perched water which may be present in discrete sand layers.

Two soil samples will be collected for TCL VOC analysis from each borehole advanced during the investigation. One soil sample will be collected from the most adversely-impacted interval as determined by head space screening. The other soil sample will be collected from a clean interval beneath the impacted zone. In the event head space screening does not identify an impacted zone, one soil sample will be collected from the base of the borehole and another will be collected from a sand unit within the boring. In the absence of a sand layer, a soil sample will be collected from an intermediate interval in the boring. In the event a perched water layer is encountered, a sample of the water will be collected for TCL VOC analysis by the project laboratory. The boring will be terminated upon encountering a perched water zone to prevent any vertical migration of contaminants which may occur by advancing the borehole through the perched water zone. The

investigation will commence at the initial boring locations depicted in Figure 2.1 and proceed outward on an iterative basis, until the areal extent of VOCs in soil and perched groundwater is delineated.

Sampling protocols for the delineation investigation are detailed in Attachment A to this Addendum. Laboratory analytical protocols detailed in the SAP will be adhered to during supplemental Site activities. Performance of this task will require an access agreement from the adjacent property owners. Additionally, work proposed will include drilling activities within or in close proximity to federally mapped wetland areas. Therefore, a permit from the Army Corps of Engineers (ACOE) may be required to conduct this task.

3.0 ADDITIONAL GROUNDWATER CHARACTERIZATION

3.1 ON-SITE GROUNDWATER SAMPLING

On the basis of the data developed during the initial sampling round, additional groundwater sampling is proposed for the 19 on-site monitoring wells summarized in Table 3.1. A supplemental groundwater sampling round is proposed for three reasons:

- i) to collect a complete set of analytical data from Unit A monitoring wells which were dry or did not produce sufficient sample volume to permit analysis for the complete list of analytes during the initial sampling round; and
- ii) to confirm the low level detections of VOCs in downgradient monitoring wells and ascertain whether VOCs are present in deeper lithostratigraphic units at the downgradient location.

During the RI, full groundwater samples could not be obtained from fourteen piezometers screened within Unit A due to lack of groundwater presence or lack of well productivity. The RI/FS Work Plan detailed the collection and analysis of groundwater samples for TCL VOCs, and SVOCs, TAL inorganics and general chemistry parameters. During the Phase II investigation, an attempt will be made to collect groundwater samples from those Unit A piezometers from which a complete round of samples could not be obtained during the initial sampling round. At piezometer locations where partial sample volumes were obtained for analysis during the initial sampling round, groundwater samples will be acquired and analyzed for those analytes for which sufficient groundwater sample volume was not obtained. Analytical data requirements for each Unit A well location are summarized in Table 3.1.

The lowermost stratigraphic unit investigated during the RI was Unit C2. VOCs were detected in only four of the 23 Unit C1 and C2 piezometers sampled during the RI (P-2C2, P-24C2, P-31C1 and P-31C2). Piezometers P-31C1 and P-31C2 will be resampled in order to verify the

TABLE 3.1

**ON-SITE GROUNDWATER SAMPLING SUMMARY
SUPPLEMENTAL RI ACTIVITIES
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA**

<i>Location</i>	<i>Quadrant</i>	<i>Parameters</i> ¹
<u>Unit A Wells</u>		
P-30A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-31A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-32A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-34*A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-11A	NW	TAL Inorganics, General Chemistry
P-33A	NW	TAL Inorganics, General Chemistry
P-10	NW	General Chemistry
P-26A	NW	General Chemistry (Excluding Cyanide)
P-23A	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-5A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-6A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-4A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-21A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-25A	SE	TAL Inorganics, General Chemistry
P-27A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
<u>Unit C Wells</u>		
P-31C1	NW	VOCs
P-31C2	NW	VOCs
P-31C3	NW	VOCs
P-31C4	NW	VOCs

¹ Analytical parameters include TCL VOCs and SVOCs, TAL Metals (total and dissolved), TAL total cyanide and the general chemistry parameters defined in the RI/FS Work Plan.

presence of VOCs observed during the initial sampling round. Additionally, piezometers P-31C3 and P-31C4 will be sampled to assess whether VOCs are present in the deeper stratigraphic units at this well cluster. Piezometer P-2C2 will not be resampled since the elevated VOC detections at this location are consistent with analytical data collected during numerous previous sampling rounds

Sampling protocols and analytical procedures which are summarized in the approved SAP will be adhered to during supplemental groundwater sampling activities.

3.2 GROUNDWATER FLOW

To obtain additional data on groundwater flow, an additional round of water level measurements will be recorded at each of the on-Site monitoring wells and piezometers screened in the B and C1 and C2 stratigraphic units which were surveyed during the previous sampling event. These data will be used to prepare groundwater contour maps from which groundwater flow will be interpreted.

3.3 OFF-SITE GROUNDWATER INVESTIGATION

In order to successfully implement the OU-1 remedy, it will be necessary to abandon all on-Site monitoring wells to facilitate regrading and capping of the Site. Moreover, the abandonment of all on-Site monitoring wells is necessary to minimize the potential for cross-contamination of geologic units which may result from monitoring wells which were improperly constructed for a landfill setting. Concurrent with abandonment of on-Site monitoring wells, a monitoring well network will be installed off Site. All or some portion of this off-Site monitoring well network may comprise the point of compliance (POC) network necessary as a component of the OU-1 remedy. POC monitoring wells will monitor the effectiveness of the eventual OU-1 remedy. It is also necessary to install additional monitoring wells off Site in order to evaluate whether Site-related

contaminants observed in on-Site monitoring wells may have migrated beyond the Site property boundaries.

In order to accomplish those objectives stated above, installation of the monitoring well network depicted in Figure 3.1 is proposed. The proposed off-Site monitoring well network consists of eight monitoring well clusters situated at the perimeter of the Site. During the RI, groundwater was observed to generally flow from the southwest toward the northeast in both Unit B and Unit C. For the most part, groundwater was found to occur only in discrete perched units above the static water table within Unit A. Monitoring wells installed below the static water table near the north and east Site property boundary will lie downgradient of refuse deposits located on Site. Therefore, the resultant network will consist of two upgradient monitoring well clusters and six downgradient monitoring well clusters located proximal to the Site.

Since the more permeable sand units within Units B and C are most likely to transmit groundwater away from the Site, these stratigraphic units will provide focus for the perimeter monitoring network. One monitoring well in each cluster will be constructed such that the screened interval will lie below the water table within the sand and silt deposits which comprise Unit B. The Unit B monitoring wells will be positioned as close to the top of the static water table as possible while still screening the more permeable sand units within Unit B. The second monitoring well in each cluster will be constructed such that the screened interval lies within the upper portion of Unit C. These monitoring intervals were selected since significant levels of Site-related contaminants were not generally observed in the B and C stratigraphic units in groundwater samples collected from the monitoring wells and piezometers located near the downgradient Site property boundaries. The one exception was the detection of VOCs at piezometer cluster P-31 in the C1 and C2 stratigraphic units.

Each of the new off-Site monitoring wells will be constructed of two-inch diameter polyvinyl chloride (PVC) risers and will be equipped with a ten foot length of No. 10 slot PVC well screen. Each well head will be equipped with a steel protective cover which will be secured by a padlock. Specific details regarding well construction and development are

provided in Attachment A to this Addendum. Once construction of the off-Site monitoring well network is completed, the position and elevation of each new monitoring well will be established by an Indiana-licensed surveyor. An elevation to the nearest 0.01 foot will be established at the top of each monitoring well casing and referenced to National Geodetic Vertical Datum (NGVD). This information will be utilized to reduce hydraulic head data collected such that groundwater flow can be interpreted.

Upon completion of monitoring well development activities, one round of groundwater samples will be collected from each of the newly-installed monitoring wells. Groundwater samples will be analyzed for TCL VOCs identified in the RI/FS Work Plan. As discussed in the Groundwater Technical Memorandum, data developed during the previous sampling round indicates that VOCs are the most important Site-related groundwater concern¹. Sample collection and analytical protocols will be implemented in accordance with those detailed in the approved SAP.

Performance of this task will require access agreements from the adjacent property owners. Additionally, work proposed will include drilling activities within or in close proximity to federally mapped wetland areas. A permit from the ACOE may be required to conduct this task. To the extent practical, off-Site monitoring wells proposed north and south of the Site will be installed within platted road easements. This will simplify the acquisition of access agreements particularly in areas where numerous small properties are platted. Prior to installation, off-Site monitoring well locations will be inspected and approved by an IDEM representative. These final well locations will not be adjusted without receiving the prior approval of IDEM.

¹The groundwater samples collected from off-Site wells will be analyzed for the most mobile and prevalent contaminant group found at this Site, namely VOCs. In general, due to the lower molecular weight and higher solubility (especially of ketones) characteristic of this contaminant group, they tend to be less effectively attenuated by geologic media and are therefore more mobile in the subsurface. Moreover, the subsurface concentration and greatest variety of contaminants found of any organic contaminant group were VOCs.

4.0 REPORTING

Upon completion of the supplemental investigative activities discussed herein, a Phase II technical memorandum will be prepared summarizing the following:

- i) monitoring well installation, development and sampling protocols adhered to during investigative activities;
- ii) analytical data compiled and validation of laboratory analytical data generated;
- iii) preparation of groundwater contour maps from which groundwater flow will be interpreted; and
- iv) an evaluation of the assembled hydrogeological and contaminant distribution data including a statistical evaluation of upgradient versus downgradient contaminant concentrations as appropriate; and
- v) adjustments to the OU-2 schedule required to complete any other delineation tasks recommended.

This Phase II technical memorandum will be submitted to IDEM within 30 days of receipt and validation of the final analytical data from the project laboratory.

5.0 MONITORING WELL ABANDONMENTS

Proper abandonment of improperly constructed wells will immediately eliminate any preferential contaminant migration pathways between distinct geologic units. Furthermore, improperly constructed wells and piezometers present an ongoing threat for cross-contamination of geologic units beneath the Site. Therefore, abandonment of all the remaining monitoring wells/piezometers should be undertaken during this phase of activities.

These monitoring wells will be abandoned consistent with the procedures outlined in Attachment A of this Addendum.

6.0 PROJECT SCHEDULE

The proposed schedule for the supplemental RI investigative activities is provided in Figure 6.1. On-Site groundwater sampling activities are scheduled to commence within 30 days of IDEM's approval of the additional scope of work or as weather conditions permit. Off-Site investigative activities will not commence until appropriate access agreements and permits are acquired.

Sampling of on-Site piezometers and collection of a round of hydraulic head data from the on-Site monitoring well network will be the first activities conducted. The off-Site investigation of Unit A and the installation and sampling of off-Site monitoring wells will be conducted as soon as access agreements from the adjacent property owners are obtained by IDEM and proper permits are acquired as necessary. The existing monitoring wells and piezometers will be abandoned following the cessation of sampling activities.

ATTACHMENT A

FIELD SAMPLING PLAN

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A.1.0 INTRODUCTION

The purpose of this Attachment is to outline the protocols to perform the supplemental investigative activities outlined in this Addendum to the RI/FS Work Plan (Addendum) which are not specifically addressed in the Sampling and Analysis Plan (SAP) provided as Appendix I of the approved RI/FS Work Plan (hereinafter referred to as "Work Plan"). This document provides amendments to the SAP required to perform the supplemental investigative work including field sampling protocols. Inasmuch as the general field protocols, analytical protocols, project organization, objectives and specific Quality Assurance/Quality Control (QA/QC) objectives are already addressed in the SAP and have not been revised, these protocols will not be repeated. Rather, these protocols are incorporated herein, by reference.

A.2.0 PROJECT DESCRIPTION

The Four County Landfill Site is located approximately one mile south of the Town of Delong in Fulton County, Indiana. History and background of the Site is presented in Sections 2.0 through 5.0 of the approved Work Plan.

A.2.1 PROJECT OBJECTIVES

The overall objective of the RI/FS is to gather sufficient information to complete an evaluation of the nature and extent of contamination at this Site for purposes of assessing risk and ultimately selecting the most suitable Site remedy. The objectives of the supplemental RI investigative activities summarized herein.

A.2.2 SCOPE OF WORK

The additional scope of work for field activities which will be performed during the RI is summarized below:

- i) determination of the areal extent of off-Site migration, if any, of perched groundwater containing leachate in more permeable units within Unit A beyond the western property boundary;
- ii) installation of off-Site groundwater monitoring wells to delineate the extent of groundwater contamination in the vicinity of the Site;
- iii) collection of groundwater analytical data from piezometers screened in Unit A, from which a complete set of groundwater analytical data specified by the RI/FS Work Plan could not be collected during the initial sampling round; and

- iv) abandonment of all remaining on-Site monitoring wells which were improperly constructed for a landfill setting and may provide preferential contaminant migration pathways.

A summary of the protocols to be adhered to during performance of the additional investigative tasks proposed is provided in the following sections.

A.2.3 RATIONALE

The rationale for conducting the additional investigative activities summarized herein are discussed in previous sections of this Addendum. Sampling and analytical protocols have been selected on the basis of the compounds observed to be a Site-related concern as a result of the data gathered to this point of the RI. The additional activities are designed to focus on specific areas of concern identified to date, during the RI.

A.3.0 GENERAL PROTOCOLS

The general protocols for equipment cleaning, field sampling, sample handling and sample documentation outlined in the SAP contained in the approved Work Plan, will be adhered to while conducting the supplemental field activities.

A.4.0 FIELD PROTOCOLS

In order to meet the objectives of the supplemental sampling program, the following field activities will be conducted:

- i) an off-Site soil boring program in Unit A including field head space screening, soil sampling and laboratory analysis, and perched groundwater (if encountered) sampling and laboratory analysis to delineate any off-Site leachate impacts;
- ii) sampling of 19 existing groundwater monitoring wells and laboratory analysis of the collected samples;
- iii) installation, development and sampling of a network of sixteen off-Site monitoring wells.

The health and safety protocols outlined in the revised Health and Safety Plan (HASP) will be adhered to during all supplemental investigative activities. Laboratory analytical and Quality Assurance/Quality Control protocols detailed in the approved Quality Assurance Project Plan (QAPP) will be followed during the Phase II investigative activities proposed herein.

A.4.1 OFF-SITE UNIT A DELINEATION INVESTIGATION

During the initial phase of the RI, elevated concentrations of VOCs were observed in groundwater samples collected from monitoring wells and piezometers screened in Unit A near the western Site boundary. The areal extent of off-Site migration, if any, of VOCs within Unit A will be determined by advancing a line of approximately eight soil borings parallel to and approximately 50 feet west of, the western Site property boundary (Site fence). The line of borings will be advanced at intervals of 100 feet commencing at a point approximately 100 feet south of the P-2 well cluster and extending to approximately 100 feet north of the P-34 cluster of piezometers as shown in Figure A.1. Off-Site Unit A delineation activities

shall not commence until appropriate access agreements have been obtained from property owners.

The soil borings will be advanced with a rotary drill rig equipped with hollow stem augers. The lead auger will be screened to permit the entry of perched groundwater, if encountered. Soil samples will be collected continuously to the base of the borehole using a split spoon sampler. In order to screen for the presence of VOCs, soil samples will be field screened using a photoionization detector equipped with an 11.7 eV lamp and head space methods. Since elevated VOC concentrations were observed in perched groundwater samples from Unit A monitoring wells and piezometers near the western Site boundary, head space screening methods will effectively determine whether elevated levels of VOCs are present in soil. If a perched groundwater unit is encountered, an attempt to collect a sample of the groundwater for laboratory analysis.

The boring program will be iterative such that in the event a boring is found to contain elevated levels of VOCs during head space screening activities, another soil boring will be advanced 50 feet to the west of the initial line of borings. The geologist may choose to advance this additional boring at a distance of 100 feet from the initial boring if the initial boring is observed to be heavily impacted by the head space screening results. If the subsequent boring is then found to be clean, another boring will be advanced between the two borings to determine the presence or absence of VOCs. In this manner, no boring determined to be clean, will be advanced more than 50 feet from a boring determined to be impacted.

All collected soil and groundwater samples will be analyzed for TCL VOCs using the analytical protocols outlined in the SAP.

A.4.2 ON-SITE GROUNDWATER SAMPLING

Groundwater samples will be collected from a network of 19 existing monitoring wells and piezometers screened in Unit A which could not be sampled for the entire list of analytes during the initial phase of

the RI. Additionally, piezometers in the P-31 cluster screened in subunits C1, C2, C3 and C4 will also be sampled.

Groundwater sampling and analysis will be performed in accordance with those protocols outlined in the SAP. At each location, collected groundwater samples will be analyzed for the constituents summarized in Table A.1.

A.4.3 OFF-SITE MONITORING WELLS

Each of the proposed new off-Site monitoring wells will be constructed of two-inch diameter polyvinyl chloride (PVC) risers and will be equipped with a ten foot length of No. 10 slot PVC well screen. Each well head will be equipped with a steel protective cover which will be secured by a padlock. Off-Site monitoring wells will be installed at the location depicted in Figure A.2.

The borehole at each location will be advanced using a nominal 6-inch diameter tricone roller bit and mud rotary drilling techniques. The borehole for the deeper monitoring well will be advanced first at each off-Site well location. Split-spoon samples will be collected at five-foot intervals during advancement of the boring in order to identify the stratigraphic units encountered. Split spoon sampling will be conducted in accordance with the protocols detailed in Section A.5.2 items i) through iv).

Specific details regarding well construction are provided below:

- i) the borehole will be advanced to the target depth using a nominal 6-inch diameter tricone roller bit and mud rotary drilling techniques;
- ii) a nominal 2-inch diameter Schedule 40 (No. 10 slot) PVC screen, 10 feet in length, attached to a sufficient length of Schedule 40

TABLE A.1

ON-SITE GROUNDWATER SAMPLING SUMMARY
SUPPLEMENTAL RI ACTIVITIES
FOUR COUNTY LANDFILL
FULTON COUNTY, INDIANA

<i>Location</i>	<i>Quadrant</i>	<i>Parameters</i> ¹
<u>Unit A Wells</u>		
P-30A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-31A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-32A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-34*A	NW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-11A	NW	TAL Inorganics, General Chemistry
P-33A	NW	TAL Inorganics, General Chemistry
P-10	NW	General Chemistry
P-26A	NW	General Chemistry (Excluding Cyanide)
P-23A	NE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-5A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-6A	SW	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-4A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-21A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
P-25A	SE	TAL Inorganics, General Chemistry
P-27A	SE	VOCs, SVOCs, TAL Inorganics, General Chemistry
<u>Unit C Wells</u>		
P-31C1	NW	VOCs
P-31C2	NW	VOCs
P-31C3	NW	VOCs
P-31C4	NW	VOCs

¹ Analytical parameters include TCL VOCs and SVOCs, TAL Metals (total and dissolved), TAL total cyanide and the general chemistry parameters defined in the RI/FS Work Plan.

PVC riser pipe to extend to the surface, will be placed into the borehole through the augers;

- iii) a filter sand pack consisting of 20-40 mesh silica sand will be installed to a minimum height of two feet above the top of the screen as the augers are removed;
- iv) a minimum three foot thick seal consisting of 3/8-inch diameter bentonite pellets will be placed on top of the sand pack and hydrated using potable water;
- v) the borehole annulus will be sealed to within three feet of the surface using a bentonite grout mixture after allowing the pellet seal to hydrate for approximately one hour.
- vi) the remaining portion of the annulus will be filled with concrete and a steel protective cover will be installed over the well. The well head will be fitted with a water-tight, lockable cap.

Figure A.3 presents the typical construction details for the off-Site groundwater monitoring wells.

Upon completion of monitoring well construction, each newly-installed monitoring well will be developed to minimize sediment in groundwater samples and establish good hydraulic communication with the aquifer. The procedures for development of newly-installed monitoring wells is summarized below:

- i) the monitoring well will be surged using a precleaned surge block for a period of at least 15 minutes;
- ii) water will then be purged from the monitoring well using a precleaned stainless steel submersible pump;
- iii) during purging, groundwater will be sampled at regular intervals and the turbidity, pH, temperature and conductivity will be measured using field instruments. These instruments

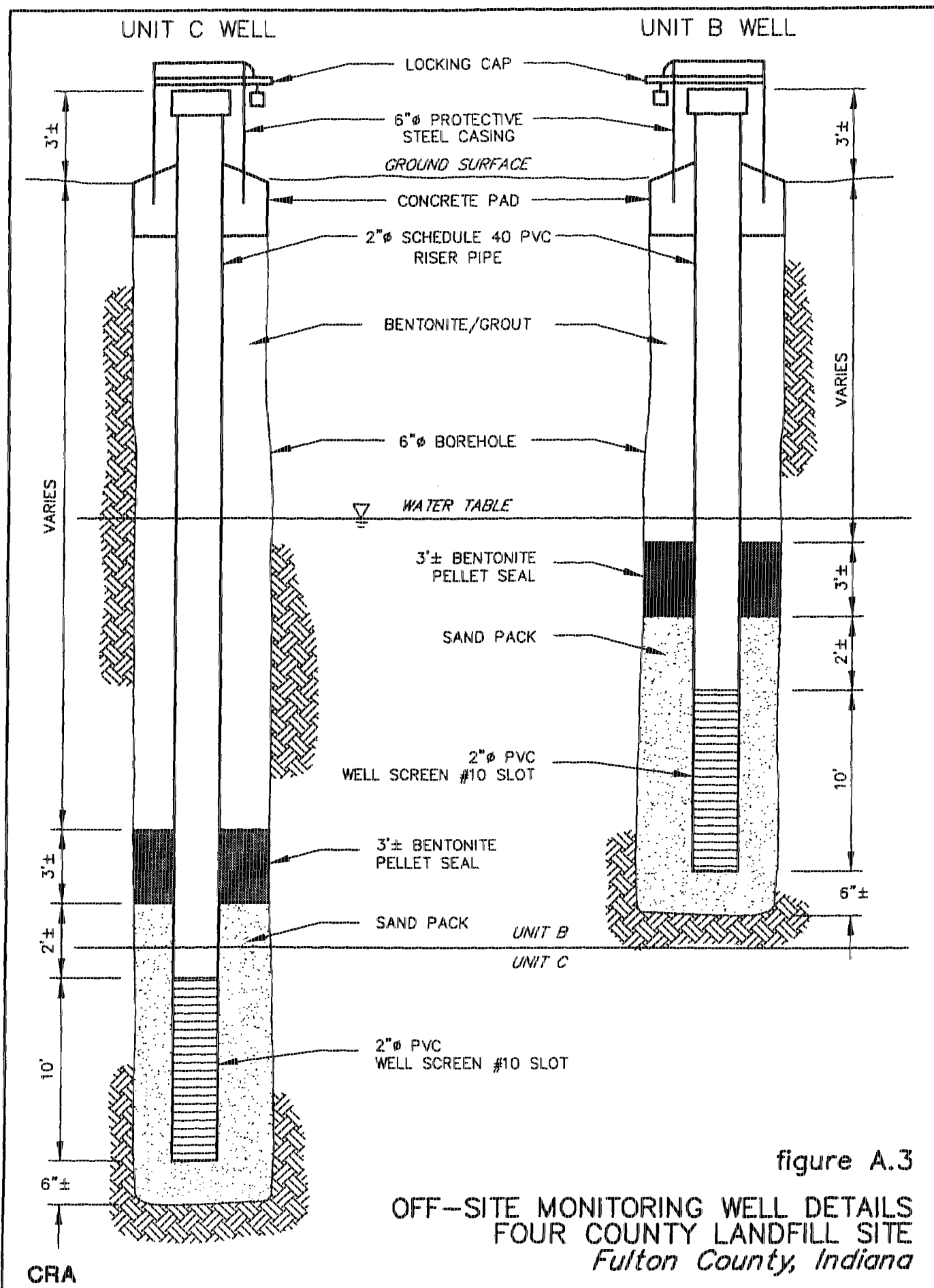


figure A.3

OFF-SITE MONITORING WELL DETAILS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

will be calibrated daily according to manufacturer's specifications. Additionally, comments will be recorded regarding the color, odor and sediment content of the purged water;

- iv) Development will continued until the turbidity and silt content of the monitoring well are significantly reduced, three consistent readings of pH, temperature and conductivity are recorded or a minimum of ten well volumes are purged as calculated below:

$$V_p = 10(0.16H)$$

where: V_p = purge volume
 H = height of the water column in the well
 $0.16H$ = one well volume

Three consistent readings for pH, temperature and conductivity will be defined as readings within ± 5 percent for conductivity and turbidity, ± 0.2 pH units, and ± 2.0 degrees for temperature.

In the event that a monitoring well is purged dry after removal of approximately one well volume, development will be resumed when the water level recovers to the level observed prior to purging. This process will continued until a minimum of five well volumes are purged.

Drill cuttings and drilling mud generated during monitoring well installation activities will be drummed and staged at a suitable location on-Site. Groundwater generated during monitoring well development and sampling activities will be transported to the leachate holding tanks present in the on-Site maintenance building.

A.4.4 MONITORING WELL SURVEY

Once construction of the off-Site monitoring well network is completed, the position and elevation of each new monitoring well will be

established by an Indiana-licensed surveyor. An elevation to the nearest 0.01 foot will also be established at the top of each monitoring well casing and referenced to National Geodetic Vertical Datum (NGVD). This information will be utilized to reduce hydraulic head data collected during subsequent monitoring events such that groundwater flow can be interpreted.

A.4.5 MONITORING WELL ABANDONMENTS

Data developed during the RI indicates that monitoring wells and piezometers which were drilled through leachate and may be responsible for the presence of VOCs in deeper stratigraphic units. In order to eliminate a preferential migration conduit to the deeper geologic units, all remaining on-Site monitoring wells and piezometers will be properly abandoned. These abandonments will be conducted by overdrilling using mud rotary or hollow stem auger methods in a manner consistent with the Work Plan.

A.5.0 SAMPLING PROTOCOLS

A.5.1 GROUNDWATER SAMPLING

Groundwater sampling will be conducted in accordance with the procedures detailed in the approved SAP. Air monitoring at each sampling location will be performed in accordance with the procedures detailed in the revised HASP.

A.5.2 SOIL SAMPLING

A.5.2.1 Off-Site Unit A Investigation

A summary of the soil sampling procedures which will be adhered to during the off-Site Unit A investigation are outlined below:

- i) The supervising geologist will identify the borehole location and the drill rig will be positioned at that location. The borehole will be advanced to an initial depth of approximately 1.5 feet below ground surface (bgs) using a screened hollow stem auger. Prior to the commencement of drilling, all equipment will be precleaned using the protocols outlined in the SAP.
- ii) Split spoon samples will be collected using a 2-inch diameter, 24-inch long split spoon sampler. The split spoon sampler will be advanced using ASTM Method D-1586-84. Split spoon samples will be collected continuously below a depth of 1.5 feet bgs. The geologist will don a new pair of disposable latex or nitrile gloves prior to handling the samples from each depth interval.
- iii) The split spoon will be opened and a measured portion of the sample representative of the entire recovered length, will be placed immediately into a laboratory-supplied jar which will be stored in a cooler containing ice. A second sample aliquot will be placed into a zip-lock bag, tightly sealed and then agitated to break up clumps of soil.

The geologist will then describe the soil sample using the Unified Soil Classification System (USCS) paying particular attention to the presence of sand seams which may contain perched water, unusual staining or odors, etc., which may be indicative of contamination. These activities will be conducted for each sample interval.

- iv) After approximately five minutes, the geologist will record a head space reading from the sample placed in the zip-lock bag. This will be conducted by inserting the probe of the PID into the zip-lock bag and recording the highest PID reading. In the event that the investigation is conducted during periods when the temperature is below 70°F, the sample in the zip-lock bag will be warmed using a secondary heat source such as a car heater, to enhance volatilization of compounds from the soil. All head space readings will be recorded in the field book.
- v) The boring will be terminated upon encountering a perched groundwater layer or 25 feet bgs, whichever occurs first. If a perched groundwater layer is encountered, the augers will be advanced to a depth which will allow collection of a water sample through the screened augers. A groundwater sample will then be collected by purging the auger of one volume of contained water using a precleaned stainless steel bailer. Upon completion of purging, a groundwater sample will be collected for laboratory analysis.
- vi) At least two soil samples will be collected from each soil boring. One soil sample will be collected from the interval exhibiting the highest head space reading and the second sample will be collected from a clean interval beneath the impacted zone. In the event elevated head space readings are not encountered in a boring, one soil sample will be collected at the base of the borehole and one soil sample will be collected from a more permeable zone such as a sand layer or from an interval above a perched water layer.
- vii) Upon completion, each borehole will be backfilled using bentonite pellets. Any remaining soil will be placed in 55-gallon steel drums and staged at a designated location on Site.

A.5.2.2 Monitoring Well Boreholes

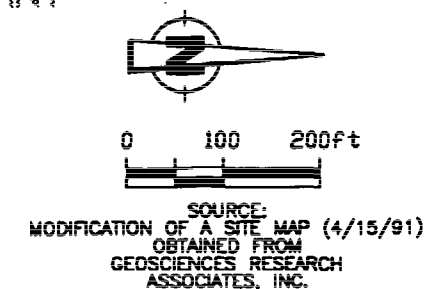
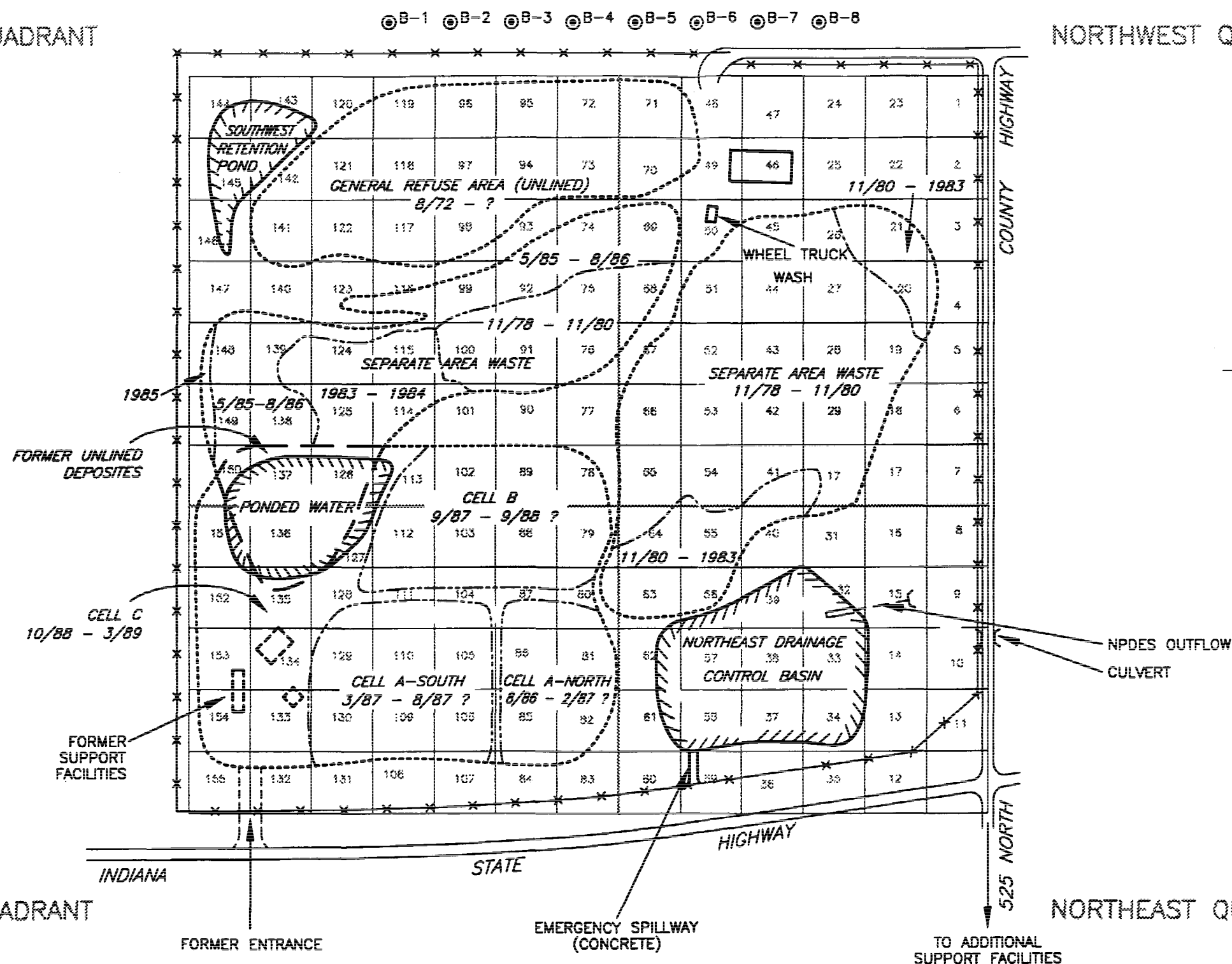
Soil sampling conducted during the advancement of the boring at the deep off-Site monitoring well locations will be conducted using the procedures described in Section A.5.2.1 Items i) through iv), except that split spoon samples will be collected at five foot intervals until the target monitoring interval is reached. Moreover, soil samples will be collected for field identification and will not be collected for laboratory analysis.

A.6.0 ANALYTICAL PROTOCOLS

All chemical analyses will be conducted in accordance with the USEPA-approved laboratory analytical methods discussed in the QAPP.

SOUTHWEST QUADRANT

NORTHWEST QUADRANT



LEGEND

- 155 BLOCK NUMBERS OF GRID
- X — X — FENCE LINE
- B-1 ⊙ PROPOSED BORING LOCATION AND IDENTIFIER

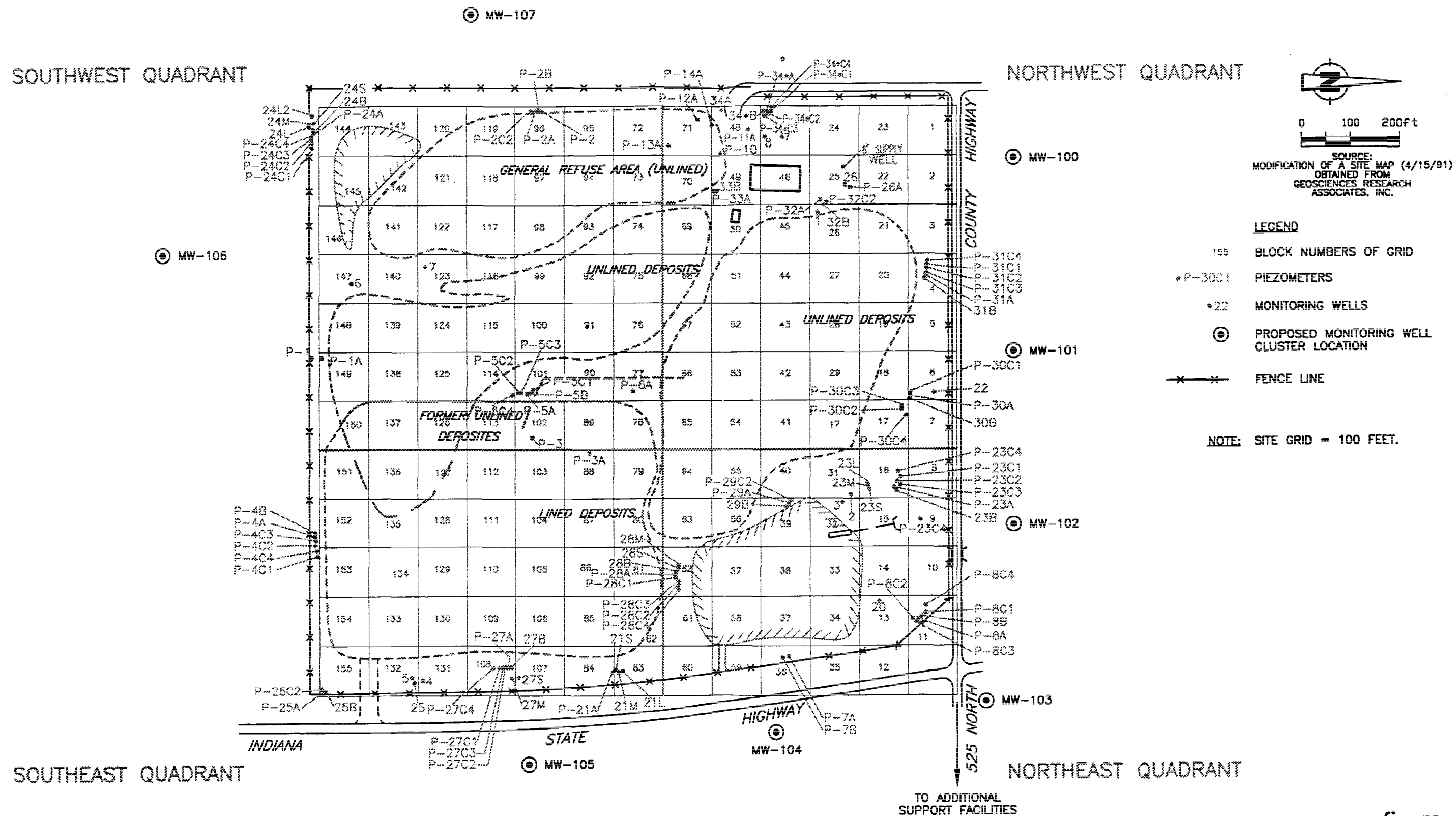
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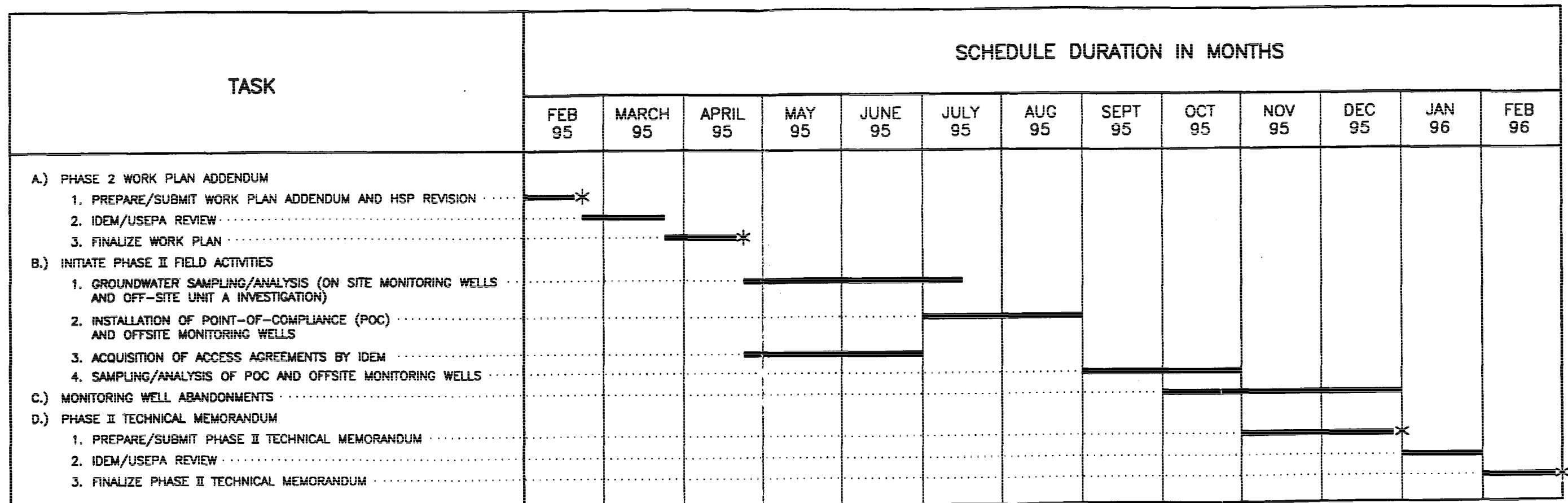
LOCATION OF OUTLINES (---, - - - - -) ARE APPROXIMATE.
SITE GRID = 100 FEET.

SOUTHEAST QUADRANT

NORTHEAST QUADRANT

figure 2.1
INITIAL BORING LOCATIONS
OFF-SITE UNIT A INVESTIGATION
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana



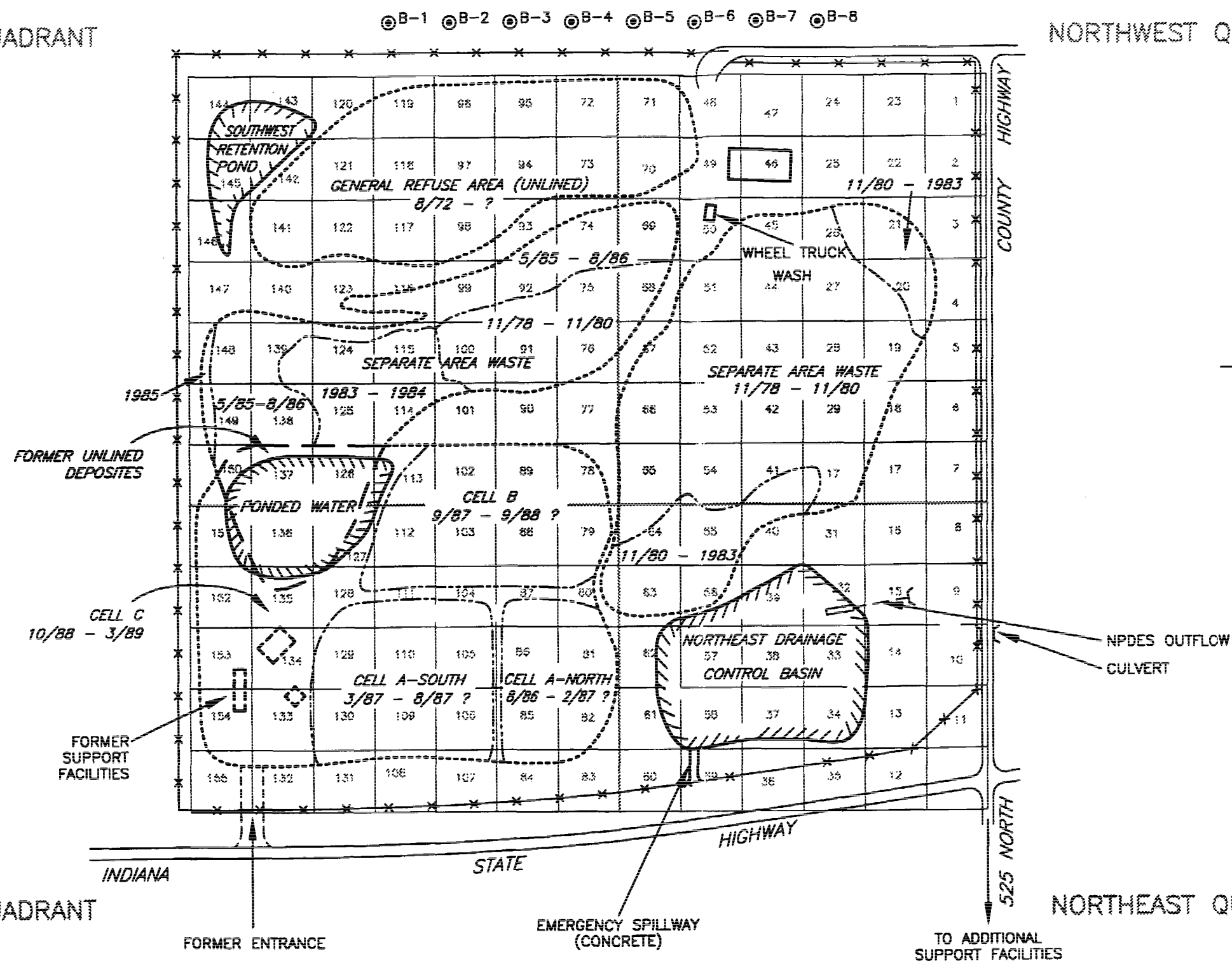


* MILESTONE EVENT

figure 6.1
PROJECT SCHEDULE
PHASE II INVESTIGATIVE ACTIVITIES
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

SOUTHWEST QUADRANT

NORTHWEST QUADRANT



0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91)
OBTAINED FROM
GEOSCIENCES RESEARCH
ASSOCIATES, INC.

LEGEND

- 155 BLOCK NUMBERS OF GRID
- FENCE LINE
- B-1 PROPOSED BORING LOCATION AND IDENTIFIER

NOTES

LOCATION OF OUTLINES (---, ---, ---)
ARE APPROXIMATE.

SITE GRID = 100 FEET.

SOUTHEAST QUADRANT

NORTHEAST QUADRANT

figure A.1

INITIAL BORING LOCATIONS
OFF-SITE UNIT A INVESTIGATION
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana

SOUTHWEST QUADRANT

NORTHWEST QUADRANT

⊙ MW-106

⊙ MW-107

⊙ MW-100

⊙ MW-101

⊙ MW-102

⊙ MW-103

⊙ MW-104

⊙ MW-105

SOUTHEAST QUADRANT

NORTHEAST QUADRANT



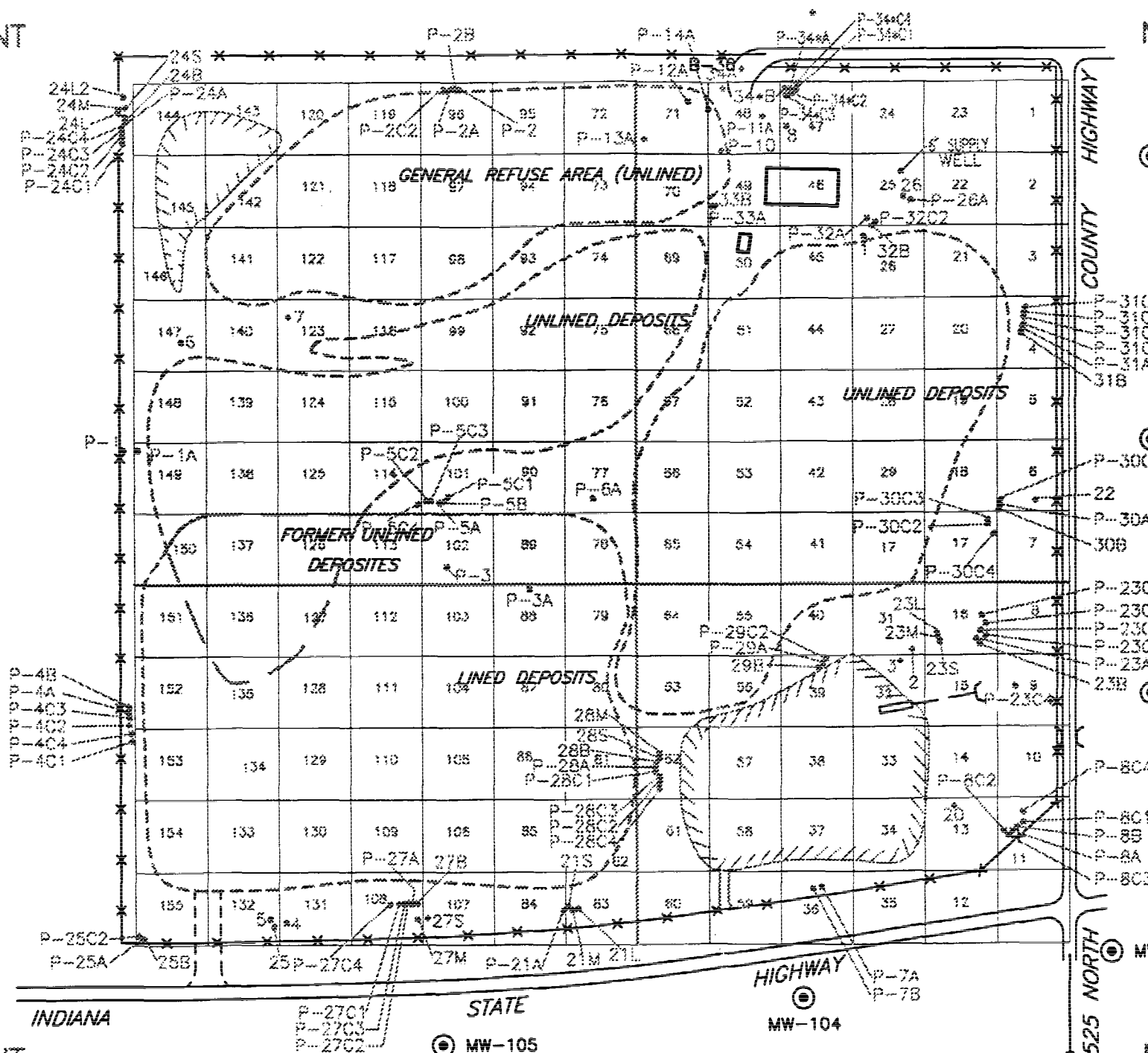
0 100 200ft

SOURCE:
MODIFICATION OF A SITE MAP (4/15/91)
OBTAINED FROM
GEOSCIENCES RESEARCH
ASSOCIATES, INC.

LEGEND

- 155 BLOCK NUMBERS OF GRID
- P-3001 PIEZOMETERS
- 22 MONITORING WELLS
- ⊙ PROPOSED MONITORING WELL CLUSTER LOCATION
- FENCE LINE

NOTE: SITE GRID = 100 FEET.



TO ADDITIONAL
SUPPORT FACILITIES

figure A.2

OFF-SITE MONITORING WELL CLUSTER LOCATIONS
FOUR COUNTY LANDFILL SITE
Fulton County, Indiana